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ABSTRACT

The paper discusses ways in which the Apple II plus and Apple IIe computers can be adapted to become highly effective tools in the education of the physically/multiply handicapped student. The role of word processing programs as communication aids, alternative input and output devices, and innovative software programs is examined. Among the adaptions and modifications considered are commercially available adaptive switches that make it possible to use a simple switch to run adapted software. The computer keyborad is needed only for some initial set-up performed by an instructor or aide. The procedures for selecting the appropriate switches to maximize independence are described, and ways in which the configurations of hardware can be tested, adjusted, and re-assessed by non-engineering staff persons are described. Training the individual to use the switch with maximum efficiency is then considered, along with new developments in the accessibility of software. (CL)

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Micro Application for the Multiply Handicapped in a Public School Setting

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Micro Applications for the Physically/Multiply Handicapped in the Public School

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There is a critical need to explore and implement cost-effective, individually presented instruction for the handicapped individual in order that he/she may more fully realize personal, communicative, educational and vocational potential. Admission to F.J. Gaenslen School, a Milwaukee Public School, is based upon the need for special education opportunity due to some form of physical handicap, the most prevalent of which are cerebral palsy, muscular dystrophy, spinal bifida, cardiac conditions, and spinal cord lesions. In addition to being physically handicapped, a large percentage of the students are multiply handicapped; i.e. have one or more of the following conditions along with their physical handicap; learning disability, mental retardation, educational retardation, auditory disability, visual disability or emotional disturbance.

The staff of Gaenslen School acknowledges the fact that the microcomputer is a tool which can expand the abilities of the handicapped. Typically, the physically/multiply handicapped student is unable to work in a regular educational setting with the customary tools or skills of the "normal" student. The student may not be able to communicate by means of oral expression or complete paper and pen tasks due to their physical disability. Further, the handicapped student's slow rate of response lengthens instructional time and therefore increases personnel and educational costs. Finally, since no students are functioning with the identical set of handicaps, or on the same instructional level, it is imperative that we find a way to provide structured, individually planned and, more importantly, individually presented instruction.

Creative application of the interactive teaching abilities of the microcomputer, use of word processing programs as a communication aid for the person unable to make use of conventional oral and written communication techniques, use of alternative input and output devices, and utilization of the increasing number of software

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programs written or adapted for use by the differently-abled are some of the techniques used by the staff at Gaenslen School to enable students to more fully achieve their potential. It is our premise that the addition of a few specialized devices can give the Apple Computer significantly more power as a tool for the handicapped person.

The first and perhaps most significant way in which we have made the Apple II plus and Apple IIe accessible to students is by bypassing the computer keyboard. A variety of adaptive switches are now available commercially which make it possible to use a simple switch to run adapted software, and the computer keyboard is needed only for some initial set-up performed by instructor or aide. The switches we are using are available from the Zyco Company. We have found that a variety of switches enables us to select the switch which is most appropriate for an individual. Switches can be positioned alongside any part of the body over which the individual has some voluntary control -- be it head, shoulder, foot or even eyebrow. One student operates a highly delicate leaf switch by the slightest head movement, a tread switch is operated by a palsied arm or foot or elbow. It is important to note two things regarding use of special switches. First, switches must be interfaced to the computer in one of several ways: through a commercially developed interface, available from several of the adaptive aids companies; through a keyboard emulator such as the Adaptive Firmware Card (to be discussed later); or through some creative engineering on the part of someone with the necessary expertise. For example, our switches are interfaced through the same paddles which were modified by placing a jack into the potentiometer of the game paddles. It is also noted that the game paddles and joystick firing buttons can function as adaptive switches for some students.

The second point of note is that adaptive switches will only operate software which has been specially written to accept input by single or dual switches. Judicial searching will yield a rather limited but growing body of software

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that fits this description, and it behooves us to make software producers aware of the need for more of this kind of software.

After a student has been evaluated by education therapist (speech, occupational, and/or physical), the next step is to develop means to position the switch for independent use by the student and to train the student to use the switch with maximum efficiency. We have found the Zyso Adaptive Fixtures Kit invaluable in making it possible for non-engineering staff persons -- occupational and physical therapists, classroom teachers, speech pathologists -- to effectively mount and position switches for use by students in a variety of settings. The kit consists of a selection of hardware including clamps, adapters, tubes, flexible rods, fixed rods, mounts and other completely interchangeable parts. With the kit, configurations can be developed, tried and modified as needs develop, and replacement parts ordered. With experience, improved configurations become apparent which may better meet the needs for proper positions. For example, we initally prepared configurations which included fixed-rod mountings for two cerebral palsy students, but noted that as students gained more experience with their switch and mount, their position tended to change, thereby diminishing some of the effectiveness of the configuration. Configurations were then easily modified by interchanging flexible gooseneck tubing for the fixed-rod portion of the mount, enabling the therapist or teacher to easily adjust for the student's variation in position. We wish to emphasize that it is experience and an open mind that are prerequisites to effective use of the kit, rather than engineering abilities.

The next step is to train the individual to use the switch with maximum efficiency, and there are two suggestions which we offer for this purpose. Gaming software which accepts single switch input can be an excellent means for teaching the individual to interact with the computer via the switch. For so long the differently-abled person has been unable to try so many of these highly stimulating

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and motivating opportunities. We have also found the software "Motor Training Games" by Computers to Help People, Inc.,(Madison, Wisconsin) to be invaluable in training even the youngest non-verbal multiply handicapped members of our population to interact with the computer and with their environment. One or two switches can be used with a variety of activities, involving varying motor skills and levels of cognitive abilities. For example, in "Random Tones", hitting a switch causes a random tone to sound for the duration of switch closure. In "Colors/Tones" the press of the switch causes random change of color and a random tone to sound for the duration of switch closure. In "Davy's Visits", the student has beginning one to one correspondence opportunities. There is simple counting, where the computer will count the number of times the student presses the switch and show that number; and there is matching, where the computer will display a number and the student attempts to match it by counting out that number with the switch. There are two drawing routines on the menu; students have the opportunity to move a cursor around the computer screen via a single or dual switch control. Also included are two routines involving letter and word recognition, both of which have opportunities for rate of scan input by the teacher/therapist, and there are several saming activities on this disk. In all, there are 13 items on the menu, and the diskette is available for ten dollars.

As stated earlier, a still relatively small body of software is commercially available to accept input by adaptive switches. There is however, a rather new piece of technology coming out of the prototype stage which makes almost all software accessible by single switch. This new technology is variously described as a "keyboard emulator", or as giving the switch-user "transparent" access to the computer. The keyboard is bypassed by means of a switch, since the keyboard is nothing more than a series of four rows of switches. The keyboard emulator to be discussed here is the "Adaptive Firmware Card", available from Adaptive Peripherals, Seattle, Washington. This card, which consists of a printed circuit card inserted into any available slot in the back of the Apple, a set-up disk,

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and an in/out box which is attached to the Apple exterior with two mini-phone jacks and a 36 pin connector for connection of an expanded keyboard, is available at a cost of $350 ($300 for the II and II plus version). The card allows access to the computer using 16 different input methods:

Regular keyboard input

Scanning: regular scan, inverse scan, step scan

Morse Code: single or dual switch morse code

Assisted Keyboard: The open and solid-apple keys are used to duplicate the action of the SHIFT and CONTROL keys, eliminating the need to hold down two keys at the same time.

ASCII input: These modes slow the Firmware Card to act as a keyboard interface for some portable communication devices.

Expanded Keyboard: Allows use of a membrane keyboard, large or small keypads, etc.

There are some other further options available.

The card utilizes the bottom two lines of the video display as an alphabet array. The therapist/teacher selects the input method using a thumb dial, and sets a rate for input. For example, if the scanning mode is selected, the teacher then sets a scan rate based on the student's ability. A highlighting cursor scans across the alphabet in groups. When the cursor settles on the desired group, the switch is tapped. The cursor then scans through the selected group letter by letter, and the switch is tapped when the desired letter is highlighted by the cursor. There are punctuation marks, numbers and control characters in the scanning array. Thus, if the student is using a piece of commercial software which requires input of a spelling word, the computer will accept the student's input of that word using the transparent access of the Firmware Card. It must be noted that input is slow, and that it requires a relatively high level of cognitive functioning.

However, once again the student has access to something which he/she has never before had the opportunity to utilize-highly motivating, individually presented instructional lessons in the context of an exciting new technology.

The final piece of technology which we have found to be a valuable and flexible resource is the Echo II Speech Synthesizer. In the past few months this synthesizer and software package has been upgraded and the voice quality is now very acceptable. The Echo II consists of a printed circuit card which is plugged into any available slot in the back of the Apple, a small speaker, and a software disk. With the purchase of certain voice-synthesized software, the synthesizer can be purchased for under one hundred dollars. Currently, we are using the Echo II in two ways. First, we are using it in a rather limited way with the Adaptive Firmware Card. By using the scanning mode to select letters to form words, some non-vocal students are using it to pronounce words which they spell or read. Second, and most significantly, speech and language pathologists are using the Echo II with the Laureate Learning Systems voice-synthesized software to teach vocabulary and syntax to young students with receptive vocabulary deficits. Our speech and language pathologists find that the software is well designed with a flexible structure. The software can be controlled by either single switch or direct selection, with ample opportunity for management, response time and scan rate control.

In summary, the addition of a few pieces of computer peripherals and adaptive input and output devices can make the Apple computer a highly effective tool in the education of the physically/multiply handicapped student. These devices do not require the service of a computer expert or a rehabilitation specialist -- they require the committment and energy of creative people who want the differently-abled individual to have access to the broadest possible range of educational opportunity.

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Distributors of Adaptive Equipment

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